Certain fungicides and herbicides also can harm predator populations, both as direct toxins to *A. fallacis* and by affecting reproduction. Field studies to determine how certain herbicides affect predator populations have been inconclusive, but it is logical to assume that applications made during the winter and spring are most harmful because *A. fallacis* mites are concentrated in the ground cover at those times. To learn how various pesticides affect predator populations, consult the *Pest & Orchard Management Guide for North Carolina Apples* (Extension Service publication AG-37), or contact your county Extension agent.

Ground Cover Management

A. fallacis, *S. punctum*, and the twospotted spider mite overwinter in vegetation on the orchard floor. Thus, ground cover management is important in conserving mite predators. Orchards with poorly managed ground covers (for example, those with large numbers of broadleaf weeds and no herbicide use) generally have more abundant predator populations than well-managed ground covers with little vegetation and a clean herbicide strip.

Obviously, poorly kept orchard floors are not conducive to the overall health and productivity of the orchard, and a compromise must be found. Studies to determine the most suitable ground cover to promote predator conservation and tree productivity are in progress. For now, we recommend that you control broadleaf weeds and, during the spring, avoid herbicides that are toxic to predators.

Cultural Practices

Proper fertilization, pruning, and thinning practices all play important roles in apple mite management. Avoid excessive fertilization, particularly with nitrogen, because elevated element levels in foliage provide a more nutritious food source for mite pests and promote rapid population buildup. As previously mentioned, excessive crop loads stress trees and make them more susceptible to mite injury. Pruning is important for overall orchard productivity, and it also facilitates thorough coverage with delayed dormant oils.

Determining Biological Control Potential

Sampling Procedures

Sample orchards regularly for both pest mites and predators to determine (1) the potential for biological control when pest mites increase in numbers, and (2) the need for miticide applications when it is determined that natural enemies alone will not suppress potentially damaging mite populations.

Sample trees weekly, beginning shortly after petal fall and continuing until early August. Divide the orchard into 15- to 25-acre blocks, and within each 10 trees to sample. Choose trees that represent the tree age and variety occurring within the block. Be sure to select some trees where you expect mites to be a problem or to occur first. From each of the 10 trees, select five leaves (50 leaves total). Choose leaves from random locations on the tree, from both the interior and periphery. Use a hand or visor lens to examine the upper and lower leaf surface for live mites.

You can estimate the number of mites per leaf by determining the percentage of leaves with more than one mite. Rather than counting the number of mites on each leaf, simply keep a running total of the number of leaves sampled and the number of leaves with more than one mite. When you are done sampling, divide the number of mite-infested leaves by 50 and multiply by 100 to determine the percentage of infested leaves. This percentage is correlated with the actual mites per leaf, so that percentages of 80, 85, 90, and 95 translate to approximately 5, 7, 11, and 26 mites per leaf, respectively.

It is not necessary to sample for predators until mite densities have reached the *decision threshold level* (discussed in the next section). When this threshold is reached, sample trees for *S. punctum* by recording the number of adults and larvae observed during a 3-minute search. Conduct searches around the periphery of the trees, observing both the upper and lower leaf surfaces. If *S. punctum* populations are determined to be insufficient to reduce mite populations, examine leaves for *A. fallacis*. Count the actual number of *A. fallacis* on